CLAIMS

What is claimed is:

1. A toughened material having a diamond material comprising:

a. a diamond material selected from the group consisting of a natural diamond, a synthetic diamond, a polycrystalline diamond, and mixtures thereof;

i. wherein the diamond material is a substantially continuous matrix comprising a material having a degree of ductility that is greater than that of granules dispersed within the continuous matrix; and

ii. wherein the diamond material has a material temperature;

b. wherein the toughened material is formed by the steps comprising:

i. placing a diamond material into a chamber of a thermal control apparatus wherein the chamber has a chamber temperature;

ii. introducing a first cryogenic material into the thermal control apparatus;

iii. decreasing the material temperature in the chamber with the first cryogenic material while preventing over-stressing of the diamond material to a first target temperature ranging from -40 degrees F to -380 degrees F at a first temperature rate ranging from 0.25 degrees per minute to 20 degrees per minute;

iv. stopping the introduction of the first cryogenic material into the chamber once the first target temperature is reached;

v. increasing the chamber temperature to a second target temperature ranging from 0 degrees F to 1400 degrees F; and

vi. increasing the material temperature to the second target temperature at a second temperature rate ranging from 0.25 degrees per minute to 20 degrees per minute resulting in a toughened diamond material.

2. The toughened material of claim 1, further comprising the step of treating the toughened diamond material by the steps comprising:

a. introducing a second cryogenic material into the thermal control apparatus to decreasing the toughened diamond material temperature and while preventing over-stressing of the toughened diamond material, to a third target temperature ranging from -40 degrees F to -380 degrees F at a third temperature rate ranging from 0.25 degrees per minute to 20 degrees per minute;

b. stopping the introduction of the second cryogenic material into the chamber once the third target temperature is reached;

c. increasing the chamber temperature to a fourth target temperature from 0 degrees F to 1400 degrees F; and

d. increasing the toughened diamond material temperature to the fourth target temperature at a fourth temperature rate ranging from 0.25 degrees per minute to 20 degrees per minute.

3. The toughened material of claim 1, wherein the diamond material is treated using the first temperature rate substantially the same as the second temperature rate.

4. The toughened material of claim 2, wherein the diamond material is treated further using the steps of:

a. introducing a third cryogenic material into the thermal control apparatus to decreasing the diamond material temperature and while preventing over-stressing of the diamond material, to a fifth target temperature ranging from -40 degrees F to -380 degrees F at a fifth temperature rate ranging from 0.25 degrees per minute to 20 degrees per minute;

b. stopping the introduction of the third cryogenic material into the chamber once the fifth target temperature is reached;

c. increasing the chamber temperature to a sixth target temperature from 0 degrees F to 1400 degrees F; and

d. increasing the diamond material temperature to the sixth target temperature at a sixth temperature rate ranging from 0.25 degrees per minute to 20 degrees per minute resulting in the toughened diamond.

5. The toughened material of claim 1, further comprising the step of permitting the diamond material to soak at the first target temperature for a first period of time.

6. The toughened material of claim 5, wherein the first period of time ranges from 15 minutes to 96 hours.

7. The toughened material of claim 1, further comprising the step of permitting the diamond material to soak at the second target temperature for a second period of time.

8. The toughened material of claim 7, wherein the second period of time ranges from 15 minutes to up to 48 hours.

9. The material of claim 1, wherein the thermal control apparatus further comprises a heat exchanger disposed in the chamber to provide a cryogenic vapor to the chamber.

10. The material of claim 9, wherein the cryogenic material is released into the heat exchanger thereby absorbing heat from the chamber into the heat exchanger forming the cryogenic vapor that fills the chamber.

11. The material of claim 9, wherein the cryogenic vapor is a member of the group consisting of hydrogen, nitrogen, oxygen, helium, argon, and combinations thereof.

12. The toughened material of claim 1, wherein the first temperature rate and the second temperature rate are determined by the mass of the diamond material.

13. The toughened material of claim 2, wherein the third temperature rate and the fourth temperature rate and are determined by the mass of the diamond material.

14. The toughened material of claim 4, wherein the fifth temperature rate and the sixth temperature rate and are determined by the mass of the diamond material.

15. The toughened material of claim 1, wherein the diamond material is a laminate.

16. The toughened material of claim 15, wherein the laminate is the diamond member disposed on a member of the group consisting of a ceramic, a paper, a woven fiber, a non woven fiber, a polymer, and combinations thereof.

17. The toughened material of claim 1, wherein the diamond material has a crystalline structure.

18. The toughened material of claim 1, wherein the diamond material is bonded with a second material.

19. The toughened material of claim 18, wherein the second material is selected from the group consisting of an iron, an iron alloy, a copper, a copper alloy, a carbide, a ceramet, and combinations thereof.

20. The toughened material of claim 1, wherein the polycrystalline diamond is a coating.

21. The toughened material of claim 1, wherein the diamond material is a heat treated material.

22. The toughened material of claim 21, wherein the heat treated material is a diamond material that has been heated to a temperature of at least 180 degrees F and cooled.